

U.S.S.N. 10/004,614

Remarks

Thorough examination by the Examiner is noted and appreciated.

The claims have not been amended.

Applicants respectfully request reconsideration of Applicants claims.

Claim Rejections under 35 USC 103(a)

1. Claims 1, 3-5, 7-8, 11-12, 15-17, 19, 21, and 22 stand rejected under 35 USC 103(a) as being unpatentable over Ishii et al., (US 5,571,366) in view of Somekh et al. (US 5,643,366) or Brors et al.(EP 0276061).

Ishii et al. disclose a plasma processing apparatus whereby the plasma pressure or light emitted from the plasma is monitored in-situ and a voltage source for supplying a radiofrequency is controlled in response to the in-situ monitoring (see abstract).

Ishii et al. disclose a vertically moveable wafer support (wafer lifter) mechanism (see col 11, line 32-36; Figure 12, item 76) is disclosed to support a wafer held by an electrostatic chuck (item 12) in a face down position together with a vertically moveable pusher pin mechanism (item 77) embedded in the electrostatic wafer chuck to remove the wafer from the electrostatic chuck following wafer processing. Ishii et al. does not disclose the structure of the vertically moveable support mechanism (item 76) other than what is shown in Figure 12. Figure 12 shows the wafer support (item 76) having a left and right fingers (arms) that support the wafer processing surface from below on the periphery (item W). Ishii et al. disclose that in the face

U.S.S.N. 10/004,614

down position, the wafer process surface can be protected from being contaminated by fine particles (col 11, lines 37-40). The wafer lifter structure of Ishii et al. extends into the plasma processing volume would likely interfere with a plasma process.

Thus, the wafer support structure of Ishii et al. holds the wafer **in an upside down position with an electrostatic wafer chuck** and is further **supported** from below by a **two fingered wafer lifter touching the wafer periphery**.

Thus, Ishii et al. does not disclose several aspects of the claimed structure and operation of Applicants claimed semiconductor wafer lifter including:

“a vertically moveable wafer lifter to hold a semiconductor wafer in a face down processing position during plasma processing at a top of the plasma chamber, the semiconductor wafer and **the wafer lifter supplied with an electrical bias during plasma processing;**

wherein the wafer lifter further comprises **sidewalls defining a first diameter greater than a diameter of the semiconductor wafer and a bottom portion having a circular opening therein, said circular opening having a second diameter less than the first diameter and less than the diameter of the semiconductor wafer; and,**

U.S.S.N. 10/004,614

wherein the **semiconductor wafer periphery rests on an inner top surface of the bottom portion** defining the circular opening to **expose only the semiconductor wafer processing surface face down during plasma processing.**”

The **two fingered support** of Ishii et al. does not disclose or suggest Applicants claimed wafer lifter structure or disclose or suggest **that the semiconductor wafer and the wafer lifter supplied with an electrical bias during plasma processing;**

Moreover, the **two fingered support** of Ishii et al., extends through a **plasma volume** below the processing surface to support the wafer processing surface from below and therefore would likely interfere a plasma process, defeating the purpose of Applicants disclosed and claimed invention.

Ishii et al. further does not disclose or suggest a structure where **the semiconductor wafer and the wafer lifter are supplied with an electrical bias during plasma processing.** Rather in the apparatus of Ishii et al. the semiconductor wafer holder is taught only to be electrically biased **through the electrostatic chuck.**

Ishii et al. fail to disclose several aspects of Applicants disclosed and claimed wafer lifter structure. Moreover, and the wafer lifter of Ishii et al. operates by a different principal of operation than the claimed structure of Applicants, i.e., Ishii et al. disclose a **two fingered wafer lifter structure touching the semiconductor process face only at two points on the wafer periphery, while exposing side portions of the wafer, and extending through a plasma processing volume.** Moreover, even assuming *arguendo* that Ishii et al. disclose biasing the two

U.S.S.N. 10/004,614

fingered (armed) wafer support, which Applicants do not concede, the **two fingered wafer lifter is structurally different** from Applicants disclosed and claimed invention.

Examiner has argued that “as shown in Figure 12, the wafer lifter contacts portions of the apparatus that are applied with electrical bias and therefore, inherently, the wafer lifter will be supplied with an electrical bias.”

Applicants respectfully point out that the wafer lifter of Ishii et al. is shown to contact only peripheral portions of the wafer process surface, **which may be electrically insulated from the electrostatic chuck by an insulating layer commonly present on a processing surface of a semiconductor processing wafer.** There is no teaching or suggestion in Ishii et al., that the **wafer lifter and semiconductor wafer** is supplied with an electrical bias. Applicants respectfully reject any assertion of inherency by Examiner.

“To establish inherency, the extrinsic evidence must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill.” *In re Oelrich*, 666 F.2d 578, 581-582, 212 USPQ 323, 326 (CCPA 1981).

In Examiners most recent action, Examiner has newly asserted that, “**inherently the wafer will be supplied with electrical bias.**” Applicants note that Ishii et al. specifically disclose supplying the wafer with bias through the electrostatic chuck.

On the other hand, Somekh et al., discloses a “C” shaped wafer support (wafer lifter) with a **three fingered contact surface** (item 76, Figure 2; Figures 3A-3F) to raise a semiconductor wafer to contact a susceptor (wafer chuck) (item 155; Figures 3A-3D) (see abstract, col 2, lines

U.S.S.N. 10/004,614

6-18;). The wafer lifter three fingered contacts (76) are then **lowered and rotated** out of the way (Figure 3E; col 8, lines 50-57) and a shadow ring (item 125; Figure 3F) is moved into place to support the wafer (40) during wafer processing. The purpose of the "C" shaped wafer support **is to allow the susceptor arm to move the susceptor holding the wafer downward** into a plasma processing position **after the wafer support is removed** from the wafer (col 3, lines 1-8).

Thus, the apparatus of Somekh et al. has a different structure and works by a **different principle of operation** than the apparatus of Ishii et al., as well as Applicants disclosed and claimed invention.

Even assuming *arguendo* a proper motivation for combination, the combined references of Somekh et al. and Ishii et al. do not produce Applicants disclosed and claimed wafer lifter structure including:

"a vertically moveable wafer lifter to hold a semiconductor wafer **in a face down processing position during plasma processing** at a top of the plasma chamber, the semiconductor wafer and the wafer lifter supplied with an electrical bias during plasma processing;

wherein the wafer lifter further comprises sidewalls defining a first diameter greater than a diameter of the semiconductor wafer and a bottom portion having a circular opening therein, said circular opening having a second diameter less than the first diameter and less than the diameter of the semiconductor wafer; and,

U.S.S.N. 10/004,614

wherein the semiconductor wafer periphery rests on an inner top surface of the bottom portion defining the circular opening to expose only the semiconductor wafer processing surface face down during plasma processing.”

Applicants respectfully point out that Examiner is clearly mistaken in asserting that Somekh et al. discloses Applicants wafer lifter structure (the shadow ring of Somekh et al. is not a wafer lifter).

In further contrast, Brors et al. disclose a plasma chamber for CVD deposition including a **manipulator arm and blade (wafer lifter) that transfers a wafer from a cassette in a loading chamber** to underneath a wafer chuck located at a top portion of the plasma chamber by rotating horizontally 90 degrees. A **3-arm lifting mechanism** on the blade, each arm having ceramic fingers then lifts the wafer to contact the chuck, similar to Somekh et al.

“The manipulator arm 68 is rotated by a motor through a 90 DEG angle. The loadlock 64 is opened and the manipulator arm 68 extends carrying the blade 70 with wafer 46 into the center of the deposition chamber 16. **Three lifting arms 72 each having a ceramic finger 74** approximately one-eighth inch in diameter attached to support 71, lift the wafer 46 off the blade and contact the back side of the wafer 46, face down, with the chuck 76. A larger number of ceramic fingers can be used to avoid the necessity of prealigning the wafer to orient the flat, however, **typically 3 fingers are used with prealignment of the wafers in the cassette.**”

Examiner argues that Applicants structure is shown in Figure 14 of Brors et al. Applicants respectfully suggest Examiner is mistaken and here reproduce the only description relating to Figure 14 and the disclosed structure which **does not disclose or suggest a wafer lifter**, but discloses a **wafer clamp assembly**:

FIG. 14. A vacuum-tight reaction chamber 210 formed of metal or similar material is

U.S.S.N. 10/004,614

fitted with a cooling channel 212 and other cooling channels (not shown). A gas mix chamber 214 is attached below the reaction chamber 210. Gas mix chamber 14 is equipped with suitable cooling channels (not shown). Gas injector rings 216, 218 are connected through suitable feedthroughs in the bottom plate of the gas mix chamber 214 to sources of process gas external to the apparatus. A ring insulator 216 is used between the reaction chamber 210 and the mix chamber 214 to facilitate independent temperature control. A water cooled chuck holder 222 is located at the top of the reaction chamber. The interior faces 224 of the chuck holder 222 can be polished and sloped as shown or vertical with a step at the bottom. The upper surface of the chuck holder 222 is sealed to a quartz window 226 to provide a vacuum wall which passes radiant energy. The size of the quartz window is determined by the size of the radiant energy source 228; the larger the energy source the larger the quartz window 226 must be, allowing larger wafers to be coated. **At the bottom of the chuck holder 222 there is a ring chuck 230 of quartz or other suitable material the interior diameter of which is slightly smaller than the wafer to be processed. The wafer 232 is held face down to the ring 230 with a wafer clamp assembly 234.** An insulating ring 236 is provided to electrically insulate the chuck 222 from the reaction chamber 210. The top of the reaction chamber 210 is fitted with a plurality of exhaust ports 238. The gas mix chamber 214 is connected to the reaction chamber 210 so as to direct a flow of mixed reaction gases at the wafer 232. A gas duct 240 is used to guide the flow of gases to the wafer. A gas deflector 242 is centered in the opening between the reaction chamber 210 and mix chamber 214. The gas deflector 242 is mounted on a shaft 244 which passes through a gland 246 facilitating a slidable seal so that the gas deflector 242 may be adjusted in vertical position within the opening to deflect the gas to get a uniform deposition on the substrate. Shaft 246 is made hollow and there is a hole in the center of gas deflector 242 so that pyrometer 248 can be sealed to shaft 244 outside the vacuum. Pyrometer 248 is aimed at the wafer 232 to measure its temperature and provide feedback for temperature control.

Applicants again point out that the wafer clamp assembly of Brors et al. **is not a wafer lifter** and respectfully suggest that Examiner is clearly mistaken in asserting that Brors et al. disclose Applicants disclosed and claimed wafer lifter structure.

Thus even assuming *arguendo*, some motivation other than Applicants disclosure for combining the references, the combination of the **two-fingered** wafer lifter of Ishii et al. and the **three-fingered** wafer lifters of Somekh et al. or Brors et al. (**three lifter arms or wafer clamp assembly**), such combination does not produce Applicants disclosed and claimed wafer lifter structure or Applicants dry etching system.

U.S.S.N. 10/004,614

“Finally, the prior art reference (or references when combined) must **teach or suggest all the claim limitations**. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure.” *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

Examiner argues that one of ordinary skill could modify the apparatus of Ishii et al. “as to compose the claimed wafer lifter because such a wafer lifter structure is a suitable means for holding the wafer at the top of the chamber”. Examiner points to no teaching or suggestion in any of the references to support such a conclusion. Moreover, none of the wafer lifters in the references **teach or suggest all the claim limitations of Applicants claimed wafer lifter structure or dry etching system**.

Examiner arguments ignore the fact that the combined references do not produce Applicants claimed invention. For example, Examiner has argued that **regardless of the differences in the structure** of Applicants disclosed and claimed invention and the combined teachings of Ishii et al. and Somekh et al. or Brors et al., that “**a *prima facie* case of obviousness still exists because no unexpected results have been shown**”.

Applicants respectfully suggest Examiner is mistaken in suggesting that a *prima facie* case can be made out without showing Applicants claimed invention or suggestion thereof in the prior art.

U.S.S.N. 10/004,614

2. Claim 9 stands rejected under 35 USC 103(a) as being unpatentable over Ishii et al., (US 5,571,366) in view of Somekh et al. (US 5,643,366) or Brors et al. (EP 0276061), as applied above, and further in view of Uchida (US 5,804,027) or Ishii et al. (US 5,795,429).

Applicants reiterate the comments made above with respect to Ishii et al., Somekh et al. or Brors et al.

In addition, even assuming *arguendo*, proper motivation for combination, the combination of the teachings of Ishii et al., with Somekh et al. or Brors et al., and further in view of Uchida or Ishii et al. '429, the fact that Uchida or Ishii '429 show an apparatus with electromagnetic coils to generate electromagnetic fields does not produce Applicants disclosed and claimed invention and does not further help Examiner in making out a *prima facie* case of obviousness.

"Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure." *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

3. Claims 10 and 18 stand rejected under 35 USC 103(a) as being unpatentable over Ishii et al., (US 5,571,366) in view of Somekh et al. (US 5, 643, 366) or Brors et al. EP 0276061, as applied above, and further in view of Admitted Prior Art.

U.S.S.N. 10/004,614

Applicants reiterate the comments made above with respect to Ishii et al., Somekh et al. or Brors et al.

In Applicants discussion of the prior art, Applicants merely disclose problems with a plasma processing chamber where a wafer is held in a face-up position during plasma processing.

Thus, even assuming *arguendo*, proper motivation for combination other than Applicants disclosure, the combination of Ishii et al. with Somekh et al. or Brors et al., and further in view of Applicants alleged admitted prior art, does not further help Examiner in producing Applicants disclosed and claimed invention and does not further help Examiner in making out a *prima facie* case of obviousness.

“Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure.” *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

4. Claims 1, 3, 5, 7-8, 10-12, 15-19, and 21-22 stand rejected under 35 USC 103(a) as being unpatentable over Admitted Prior Art in view of Ishii et al., (US 5,571,366), and Somekh et al. (US 5, 643, 366) or Brors et al. (EP 0276061).

U.S.S.N. 10/004,614

Applicants reiterate the comments made above with respect to Applicants alleged admitted prior art, Ishii et al., and Somekh et al. or Brors et al.

As pointed out above, even assuming *arguendo*, proper motivation for combination of the above references, such combination does not produce Applicants disclosed and claimed invention and does not further help Examiner in making out a *prima facie* case of obviousness.

“Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure.” *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

5. Claim 9 stands rejected under 35 USC 103(a) as being unpatentable over Admitted prior art in view of Ishii et al. (US 5,571,366), and Somekh et al. (US 5,643,366) or Brors et al. EP 0276061, as applied above, and further in view of Uchida (US 5,804,027) or Ishii et al. (US 5,795,429).

Applicants reiterate the comments made above with respect to Applicants alleged admitted prior art, Ishii et al., and Somekh et al. or Brors et al. and Uchida.

As pointed out above, even assuming *arguendo*, proper motivation for combination, the combination of Applicants alleged admitted prior with and Ishii et al., and Somekh et al. or Brors et al., and further in view of Uchida or Ishii et al. '429, does not produce Applicants disclosed

U.S.S.N. 10/004,614

and claimed invention and does not help Examiner in making out a *prima facie* case of obviousness.

“Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure.” *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

Conclusion

Applicants reiterate that the references, both individually or in any combination, fail to produce Applicants claimed structure, and therefore fail to make out a *prima facie* case of obviousness.

Applicants respectfully request reconsideration of their claims and submit that the claims are in condition for allowance. Such favorable action by the Examiner at an early date is respectfully solicited.

U.S.S.N. 10/004,614

In the event that the present invention is not in a condition for allowance for any other reasons, the Examiner is respectfully invited to call the Applicants' representative at his Bloomfield Hills, Michigan office at (248) 540-4040 such that necessary action may be taken to place the application in a condition for allowance.

Respectfully submitted,

Tung & Associates


Randy W. Tung

Reg. No. 31,311

Telephone: (248) 540-4040